DIGITAL SENSORS

Patent number:	GB2255410
Publication date:	1992-11-04
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Classification:	
- international:	G01D3/08
- european:	G01D3/08; G01P21/02
Application number:	GB19910009399 19910501
Priority number(s):	GB19910009399 19910501

Abstract of **GB2255410**

A sensor 20, e.g. a wheel speed sensor, for use in a motor vehicle, produces a binary output signal which varies with the parameter to be sensed. In order to distinguish between the inactive state of the sensor and failure of the sensor, a diode 22 causes a steady offset voltage to be superimposed on the output signal of the sensor so that in both binary states of the signal output, the signal level differs from ground. The signal level may be compared with a reference level in a comparator (34, Fig. 5 not shown) to determine failure of the sensor.

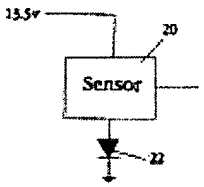

Fig. 3

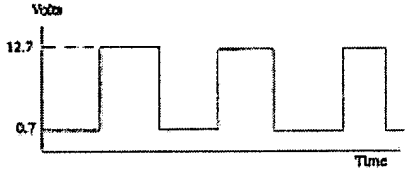

Fig. 4

(12) UK Patent Application (19) GB (11) 2 255 410 (13) A

(43) Date of A publication 04.11.1992

(21) Application No 9109399.7

(22) Date of filing 01.05.1991

(51) INT CL[5]
G01D 3/08

(52) UK CL (Edition K)
G1N NAHK N1A2P N1P N3S11 N4C N7E1
U1S S1844 S2149

(56) Documents cited
GB 2119097 A EP 0285478 A1

(58) Field of search
UK CL (Edition K) G1A AFG, G1N NACN NAHK NAJB NAJC
INT CL[5] G01D 3/08

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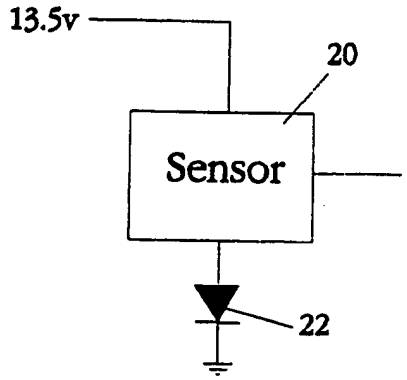
(54) Digital sensors

(57) A sensor 20, e.g. a wheel speed sensor, for use in a motor vehicle, produces a binary output signal which varies with the parameter to be sensed. In order to distinguish between the inactive state of the sensor and failure of the sensor, a diode 22 causes a steady offset voltage to be superimposed on the output signal of the sensor so that in both binary states of the signal output, the signal level differs from ground. The signal level may be compared with a reference level in a comparator (34, Fig. 5 not shown) to determine failure of the sensor.



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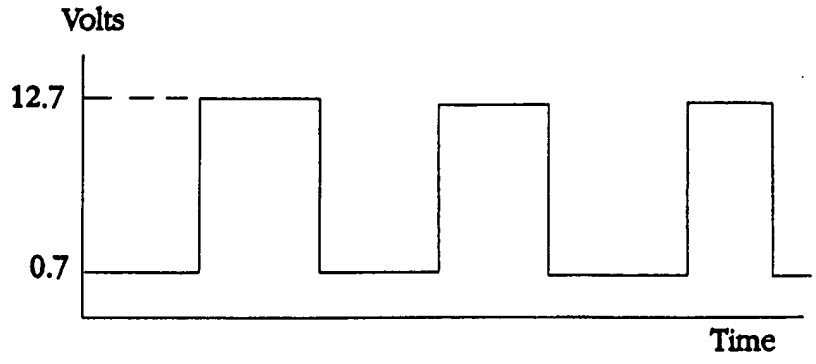

Fig. 4

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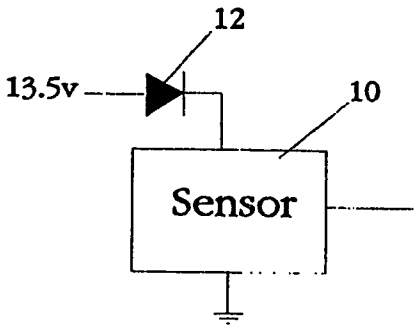


Fig. 1

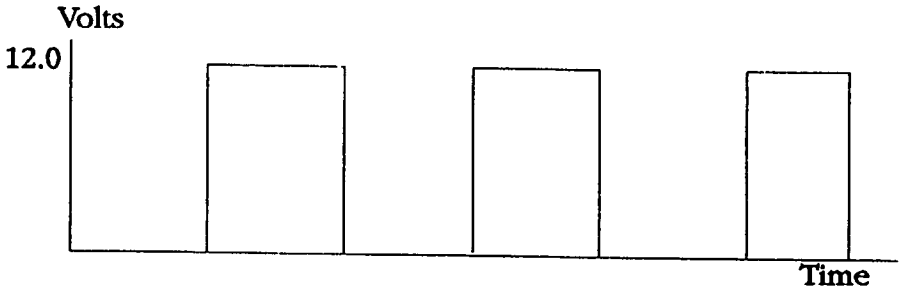
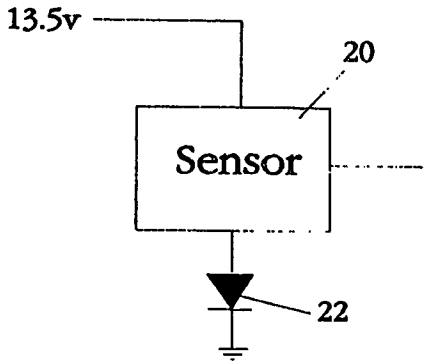


Fig. 2



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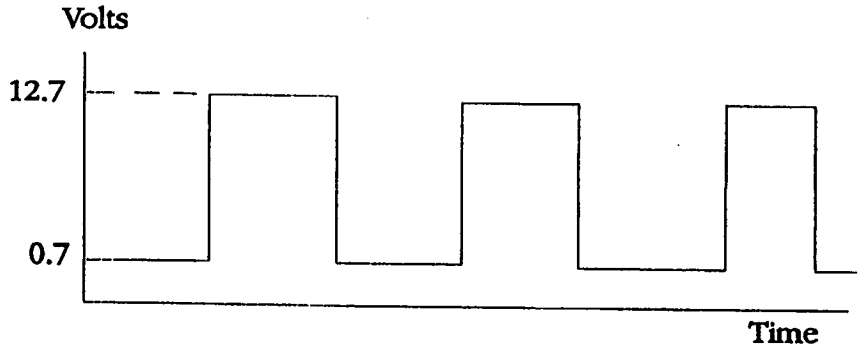

Fig. 4

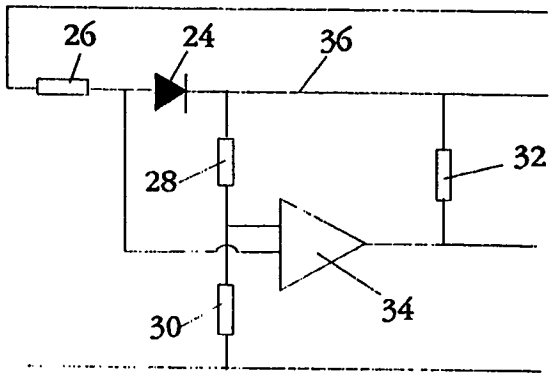

Fig. 5

Title

Digital Sensors

Field of the invention

The present invention relates to a digital sensor which in use produces a binary output signal on its output line. Such a digital sensor may, for example, be a vehicle wheel speed sensor.

Background of the invention

Various sensors for use in motor vehicles are are known which are connected to a power supply and generate an output signal in the form of a binary waveform. An example of such a sensor is shown schematically in Figure 1 and its output is shown in Figure 2.

The sensor 10 in Figure 1 is a wheel speed sensor. Its internal operation is not relevant to the invention and it may, for example, be an electro-magnetic or electro-optical sensor. As the associated wheel rotates, a series of pulses as shown in Figure is are produced, the frequency of the pulses being wheel speed dependent.

Because the sensor 10 may contain polarity sensitive components which would be damaged by improper connection to the power supply line, it is fairly common to include a diode 12 in series with the sensor. In an automotive application, the sensor body is normally connected to ground, which is at 0v and the diode 12 is therefore connected to the live terminal of the power supply, usually the positive terminal in modern vehicles.

As seen from Figure 2, the binary output signal adopts one of only two states, corresponding to voltages of 12v and 0v relative to ground, respectively.

A problem which arises with such a sensor is that it is difficult to distinguish between a stationary wheel and a faulty sensor. If for example the sensor fails or one of its wires is disconnected, a constant 0v would be sensed by the circuit connected to receive its output signal and it is not immediately obvious from this signal if the wheel is at rest or the circuit has failed in some way.

Object of the invention

The present invention seeks to provide a simple and inexpensive solution to this problem to permit the quite state of the sensor to be distinguished from sensor failure.

Summary of the invention

According to the present invention, there is provided a sensor, for use in a motor vehicle, for producing a binary output signal which varies with the parameter to be sensed, comprising means for applying a steady offset voltage to the output signal of the sensor so that in both binary states of the signal output, the signal level differs from ground.

Preferred features of the invention

Preferably, the means for applying a steady offset voltage to the output signal of the sensor comprises a circuit element arranged in the power supply connections to the sensor, between the sensor and ground.

In use, the binary output signal will vary between its maximum value and a value which is greater than zero by an amount equal to the voltage drop across the circuit element. If the binary signal should ever drop to zero, then this can no longer be attributed to the quite state of the sensor and the voltage drop can be detected and

suitable action can be taken by the circuit receiving the sensor output signal.

Advantageously, the circuit element is a forward biased diode. This not only gives a fixed voltage drop but may also serve to protect the sensor against improper connection to the power supply.

The latter embodiment of the invention is particularly preferred as it requires no components in addition to those already present in many prior art circuits in which the diode is present in the positive power supply lead to provide protection against reverse polarity.

In the circuit receiving the output of the sensor, sensor failure can be detected by simply comparing the signal with a threshold voltage lower than the offset. This requires very few additional components and may frequently be achieved without a component cost, given that multigate chips are often present in which some of the gates are redundant.

Brief description of the drawings

The invention will now be described further, by way of example, with reference to the accompanying drawings, in which:

Figure 1, as earlier described, shows a prior art circuit comprising a sensor connected to a power supply through a polarity protection diode,

Figure 2 shows the binary output signal of the sensor in Figure 1,

Figure 3 is a circuit similar to that of Figure 1, showing an embodiment of the invention,

Figure 4 shows the binary output signal of the sensor in Figure 2, and

Figure 5 shown part of a receiving circuit for detecting sensor failure.

Detailed description of the preferred embodiment

The sensor 20 in the circuit of Figure 3 has the polarity protection diode 22 connected in its ground lead rather than its live lead. The effect of this connection is that the reference voltage inside the sensor exceeds the vehicle ground by the forward bias across the diode 22. The binary output signal of the sensor therefore now varies, as shown in Figure 2, between 0.7 volts and 12.7 volts. Therefore even in the quite state, the sensor output voltage is above zero.

Figure 3 shows the part of the receiver responsible for detecting sensor failure. The signal from the sensor is applied by way of a resistor 26 to one input of a comparator 34. A diode 24 connected to the resistor 24 forms part of a clamping circuit for providing a reference voltage on the line 36 equal to the peak voltage of the binary signal. This voltage is divided in the ratio of the resistors 28, 30 to set a reference voltage of, for example, 0.5 volts, which is lower than the 0.7 volts offset created by the diode 22.

The output of the comparator 34 is held high by a resistor 34 while the sensor signal is above 0.5 volts but in the event of sensor failure, the sensor signal drops below the threshold value set by the resistors 28, 30 and the comparator output goes low, thereby indicating sensor failure and signalling the control system to take appropriate action.

CLAIMS

1. A sensor, for use in a motor vehicle, for producing a binary output signal which varies with the parameter to be sensed, comprising means for applying a steady offset voltage to the output signal of the sensor so that in both binary states of the signal output, the signal level differs from ground.

2. A sensor as claimed in claim 1, wherein the means for applying a steady offset voltage to the output signal of the sensor comprises a circuit element arranged in the power supply connections to the sensor, the circuit element being connected between the sensor and ground.

3. A sensor as claimed in claim 2, wherein the circuit element is a forward biased diode.

4. A sensing circuit comprising a sensor as claimed in any preceding claim and a receiving circuit connected to receive the binary output signal of the sensor, wherein the receiving circuit comprises a comparator for comparing the signal received from the sensor with a reference signal lower than the said offset in order to detect sensor failure.

5. A sensing circuit constructed arranged and adapted to operate substantially as herein described with reference to and as illustrated in Figures 3 and 5 of the accompanying drawings.

Patents Act 1977
Examiner's report to the Comptroller under Section 17 (The Search Report)

Application number 9109399.7

Relevant Technical fields

(i) UK Cl (Edition K) G1A (AFG); G1N (NACN, NAHK, NAJB, NAJC)

(ii) Int Cl (Edition 5) G01D 3/08

Search Examiner

M G CLARKE

Databases (see over)

(i) UK Patent Office

(ii)

Date of Search

6 JUNE 1991

Documents considered relevant following a search in respect of claims 1 to 5

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
A	GB 2119097 A (DAIMLER-BENZ AG) whole document	1
A	EP 0285478 A (BENDIX ELECTRONICS) whole document	1

Category	Identity of document and relevant passages	Relevant to claim(s)

Categories of documents

X: Document indicating lack of novelty or of inventive step.

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A: Document indicating technological background and/or state of the art.

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E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

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